

# Particulate Measurements During SUPRECIP-2: Establishing the Foundation for a Long Term Aerosol Observatory in California

Steven S. Cliff-U.C. Davis

Tony VanCuren-Air Resources Board

Kevin D. Perry-University of Utah

# Acknowledgements

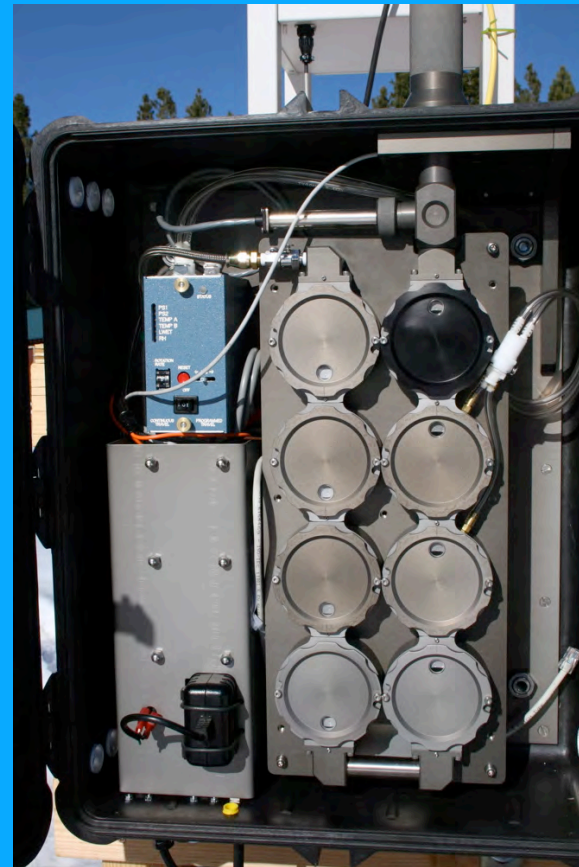
- Funding:
  - California Energy Commission-PIER
  - National Oceanic and Atmospheric Administration (NOAA)-Climate Change Program
- People and Entities:
  - Dr. Yongjing Zhao-UCD
  - Odelle Hadley-UCSD
  - Marin Water District-Mt. Tam
  - Central Sierra Snow Lab-UC Berkeley
  - Blodgett Forest Research Station-UC Berkeley
  - National Park Service-Lassen National Park

# Rationale:

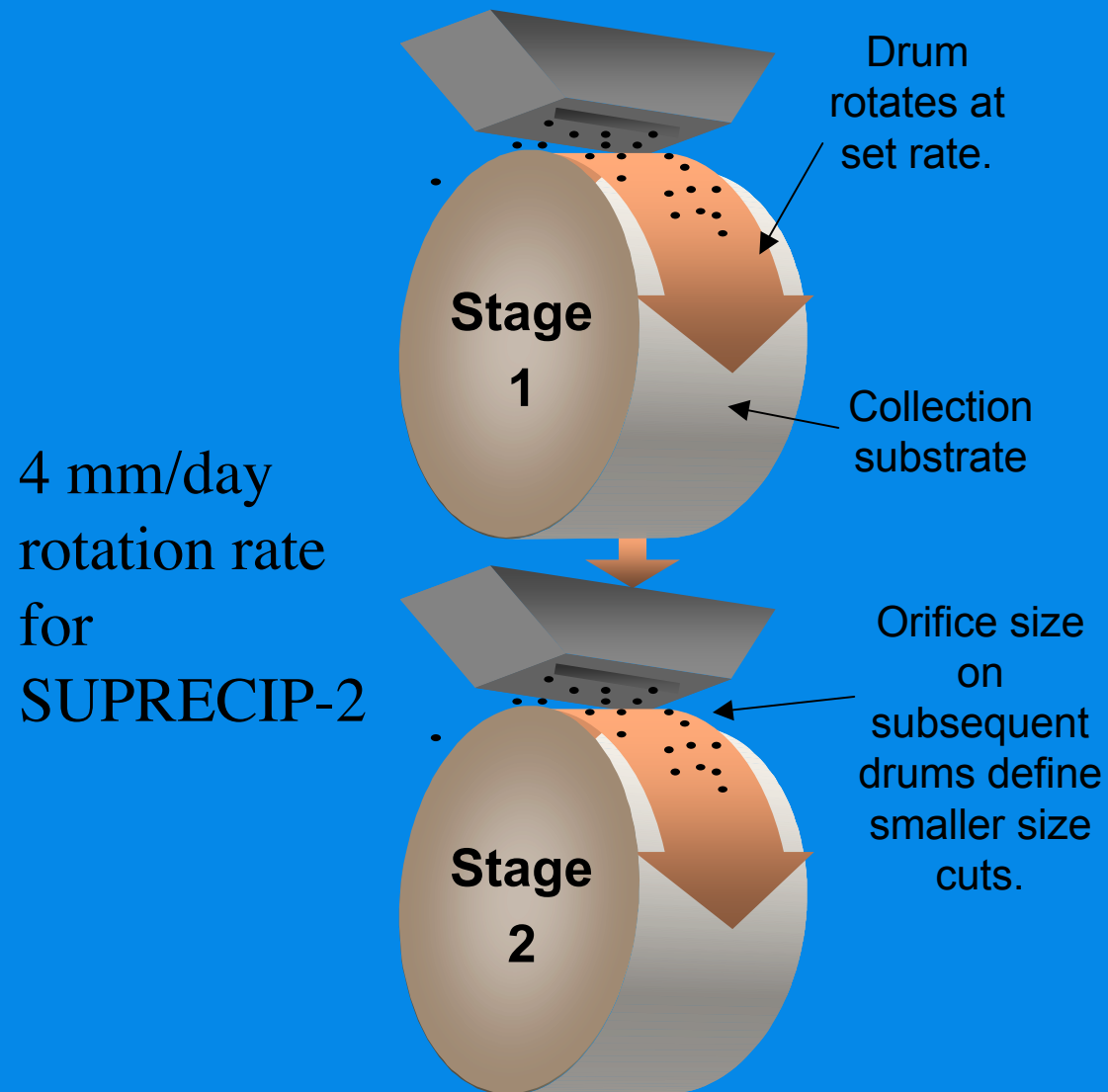
- Provide particulate data relevant to goals of SUPRECIP-2 study.
  - Reduced precipitation due to particle pollution (Rosenfeld et al.)
  - Ground based aerosol characterization to determine composition, size and transport dynamics in concert with aircraft flights.
- Establish a database and understanding of aerosols at remote sites in California as the basis for long-term observational studies for the future.
  - Propose a new long-term climate observatory in California

# Sampling tools

- Proprietary design impaction based particulate collector.
- Autonomously operates for 6-weeks in 8 size ranges.
- Time-record of aerosol sample is maintained allowing 3-hour ambient data.



# Impaction Sampling



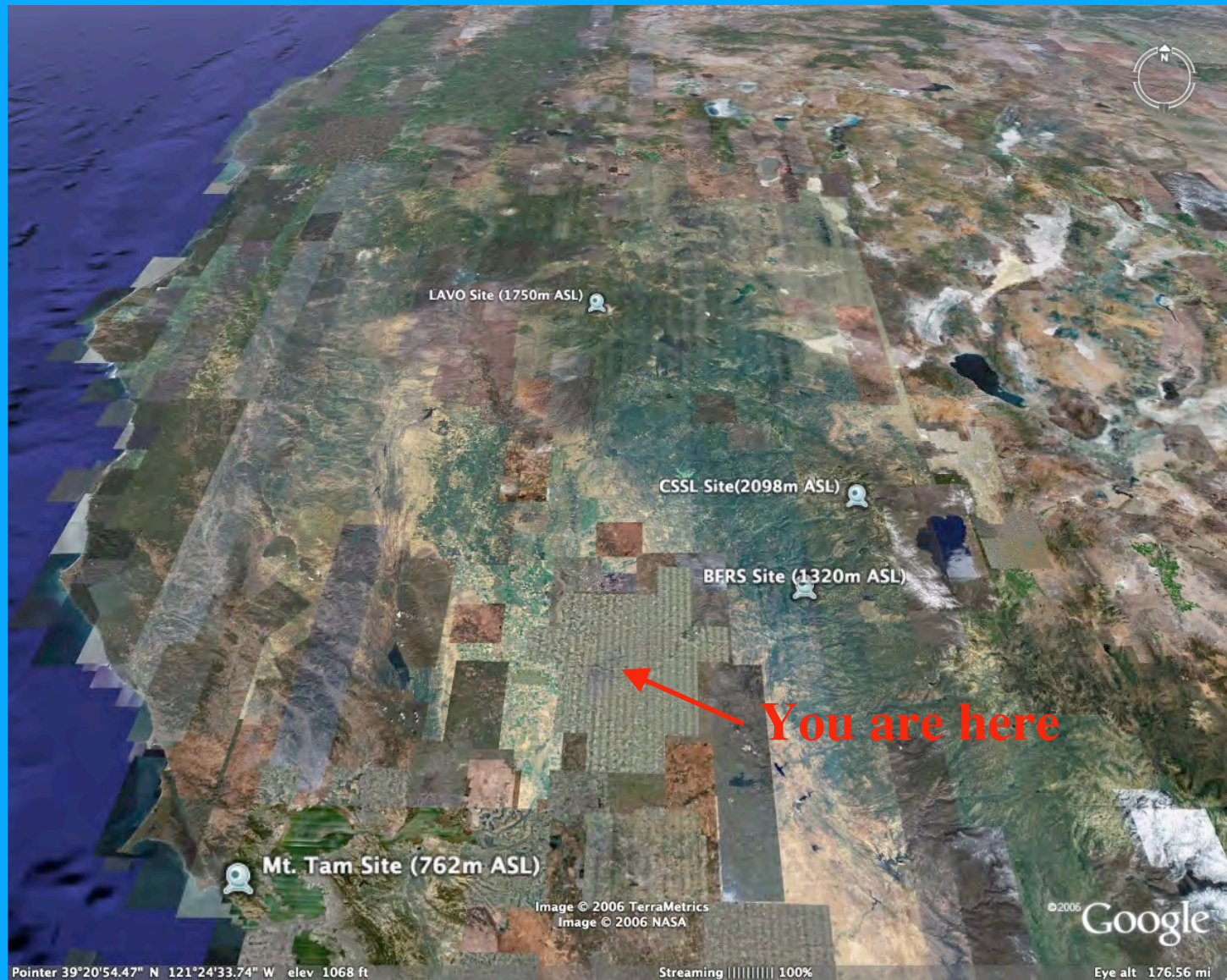
# Analysis tools

- Advanced Light Source (ALS) at the Lawrence Berkeley National Laboratory for synchrotron x-ray fluorescence (quantitative elements)
- Beta (electron emission) attenuation mass analysis (total mass per size range)



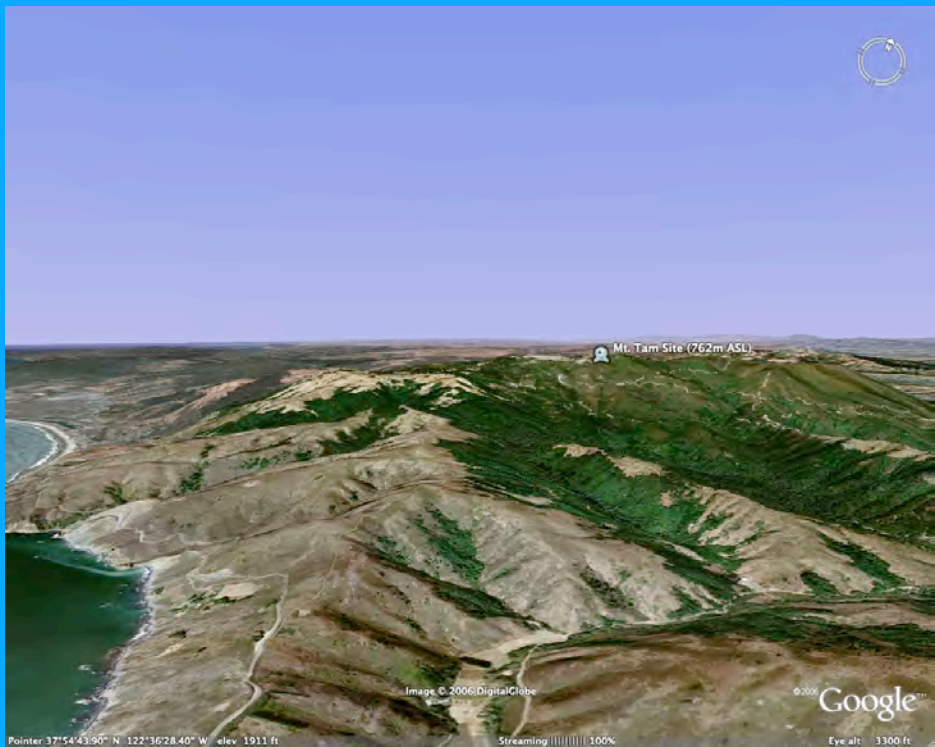


# 2006 Sampling Sites





# Mt. Tamalpais



- Started operation May 1, 2006.
- Presumed long-range transported influence with some regional and potentially local (visitors to lookout) pollution.
- Planned co-location with UCSD-SIO group (Odelle Hadley et al.) precluded by access issues (2007???)



# Lassen National Park (LAVO)



- Started operation February 23, 2006
- Impacted by regional and long-range transported air mass.
- Some minor local pollution influence during inversion.
- Co-located with UCSD-SIO (Odelle Hadley et al.).
- Co-located with IMPROVE monitoring station.

# Blodgett Forest Research Station (BFRS)



- Started operation March 7, 2006
- No significant local impact
- Regional particulate may be modified by extensive vegetation (tree cover)
- Co-located with Jim Hudson (DRI) with approximately 10 day overlap.

# Central Sierra Snow Laboratory (CSSL)



- Started operation March 3, 2006
- Impacted by mixture of local (Interstate 80, train, and woodburning home heating) and long-range transported air mass
- Associated data record (full Met., include. Precip and solar index)
- Co-located with UCSD-SIO (Odelle Hadley)



# Local Sources?

- CSSL is located between Interstate 80 and rail lines.
- Additional housing related sources.



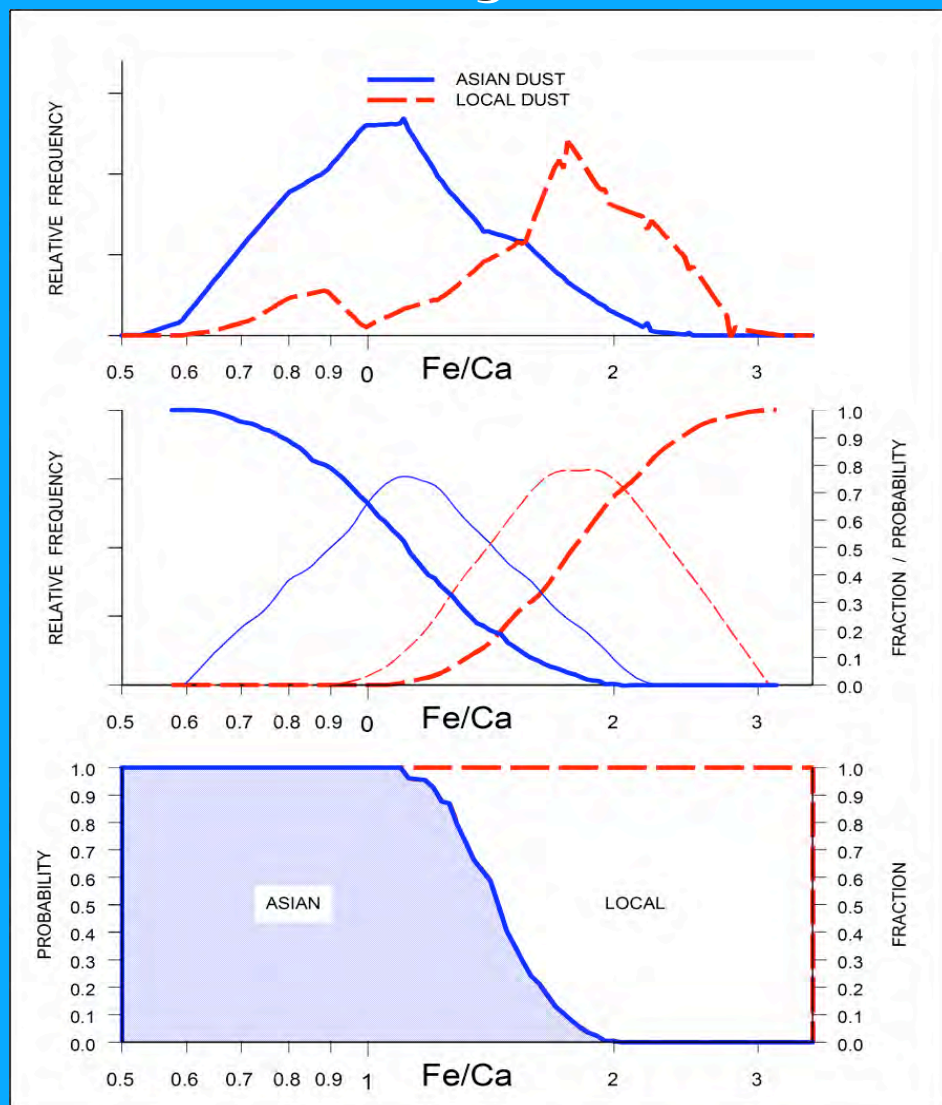
**Back to the  
future**



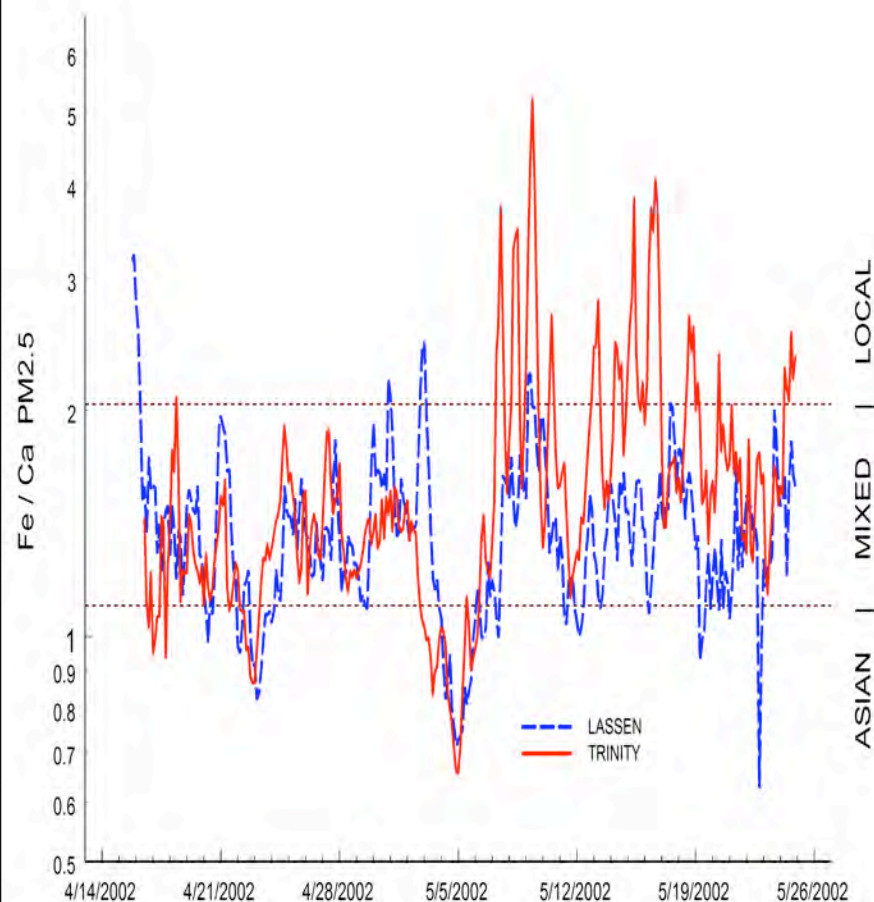


# ITCT-2K2 Findings: 2 - Air Mass Mixing State

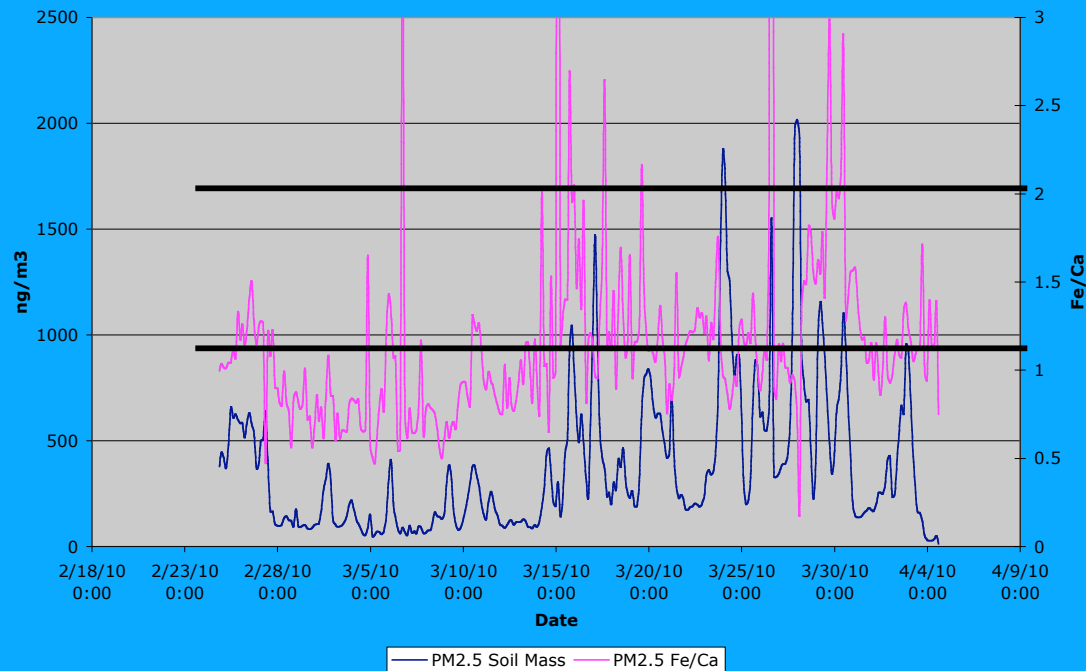
## Soil Mixing Model



## Air Mass Influence



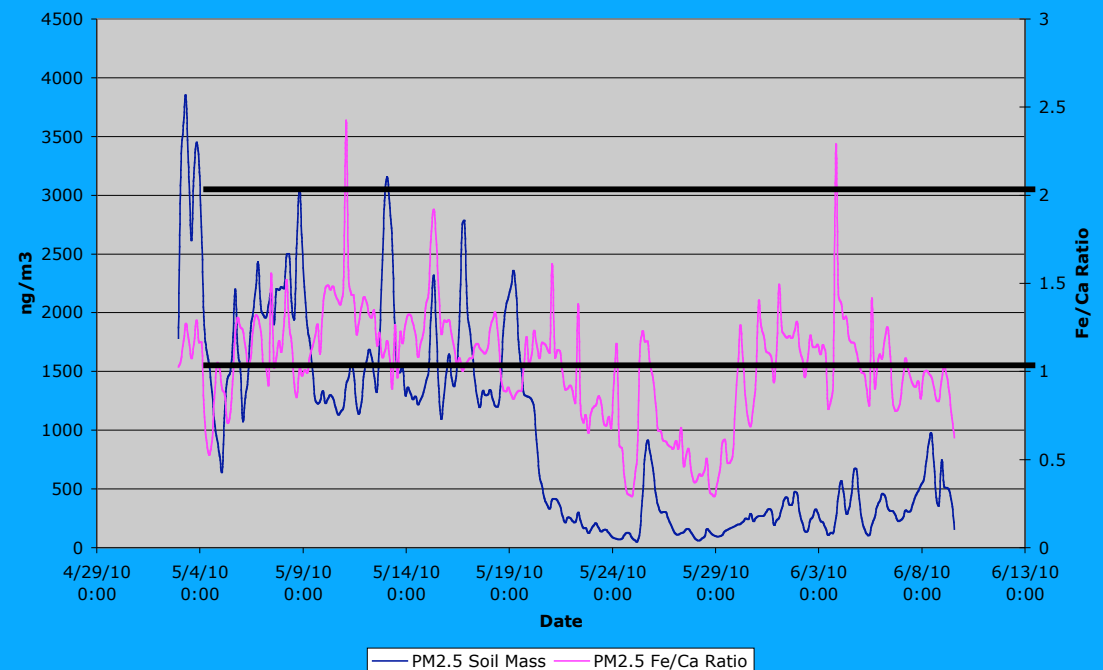
### Lassen National Park



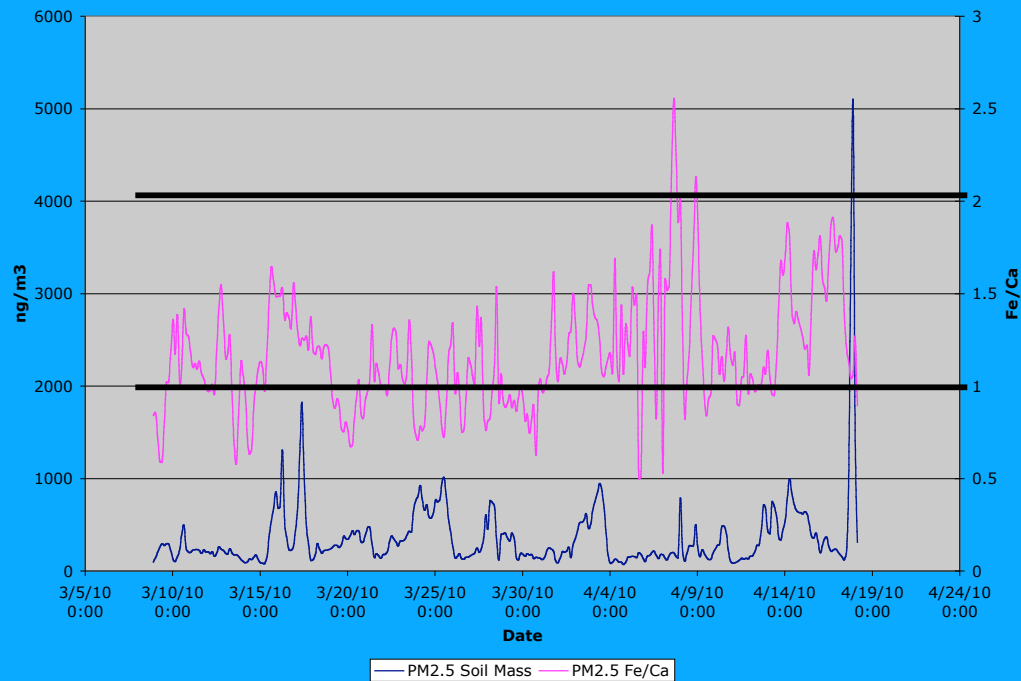
## SUPRECIP Data Spring 2006

- LAVO data from 2006 reproduces results from 2002
- Mt. Tam site observes long-range transported soil influence well into May-June period.

### Mt. Tamalpais

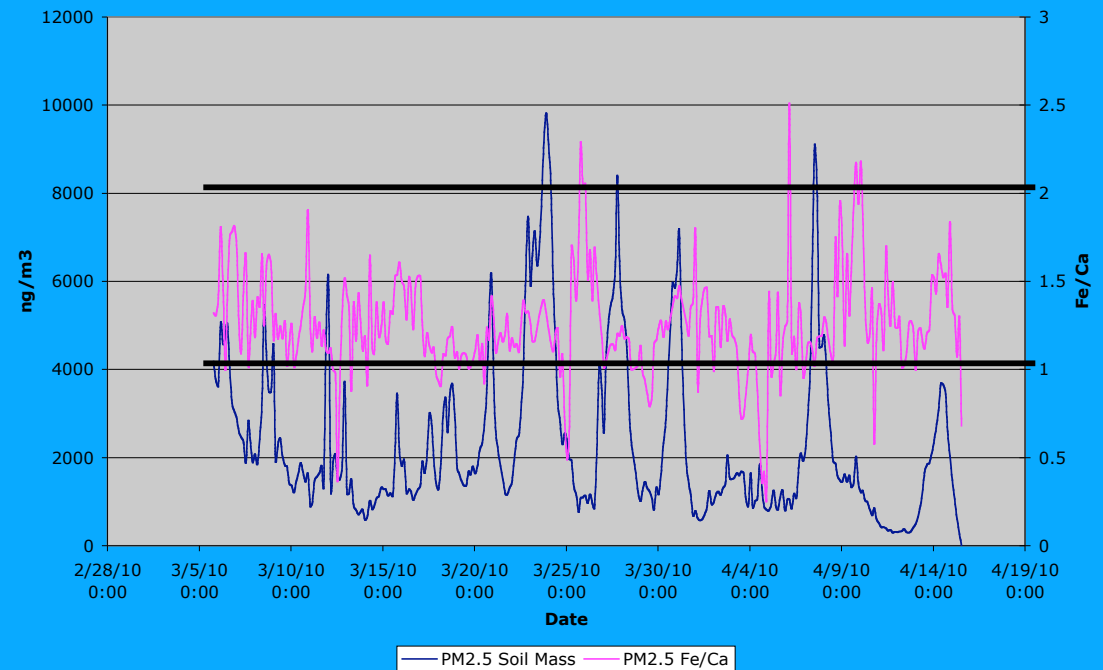


### Blodgett Forest Research Station



## SUPRECIP Data Spring 2006

### Central Sierra Snow Laboratory



- BFRS data indicate very little particle loading with generally mixed soil sources.
- CSSL site observes a mixture of local (road sanding??) and long-range transported soil. Soil levels about 3-4X other sites during SUPRECIP-2

# Particle variability in Sierra-Cascade Sites is low

Figure 2-13. Fine sulfate (<2.5  $\mu\text{m}$  diameter) Concentration Frequency Distributions.  
(The geometric means are marked with bars and the Crater Lake mean is repeated on all plots for comparison.)

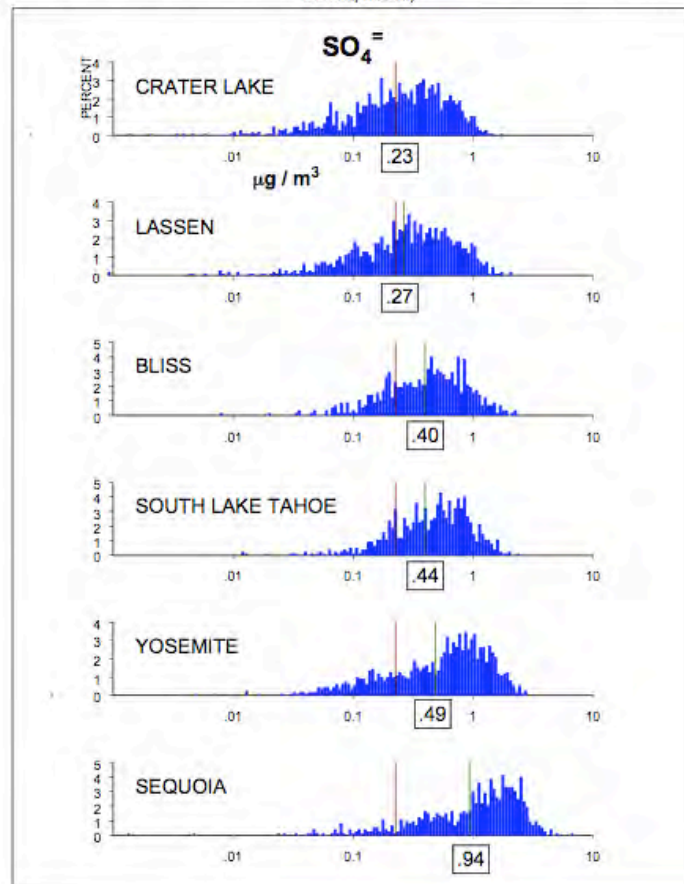
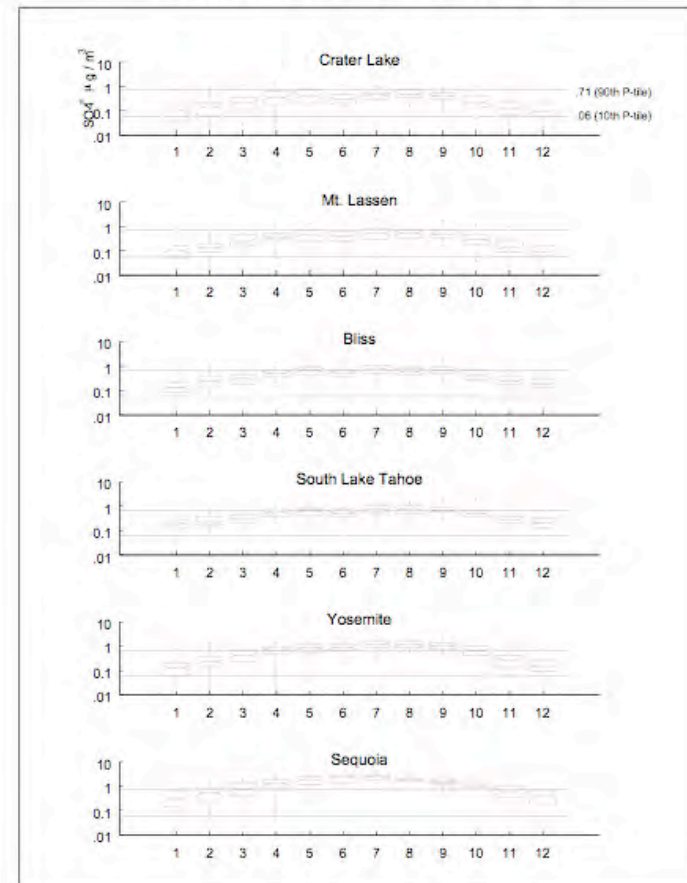


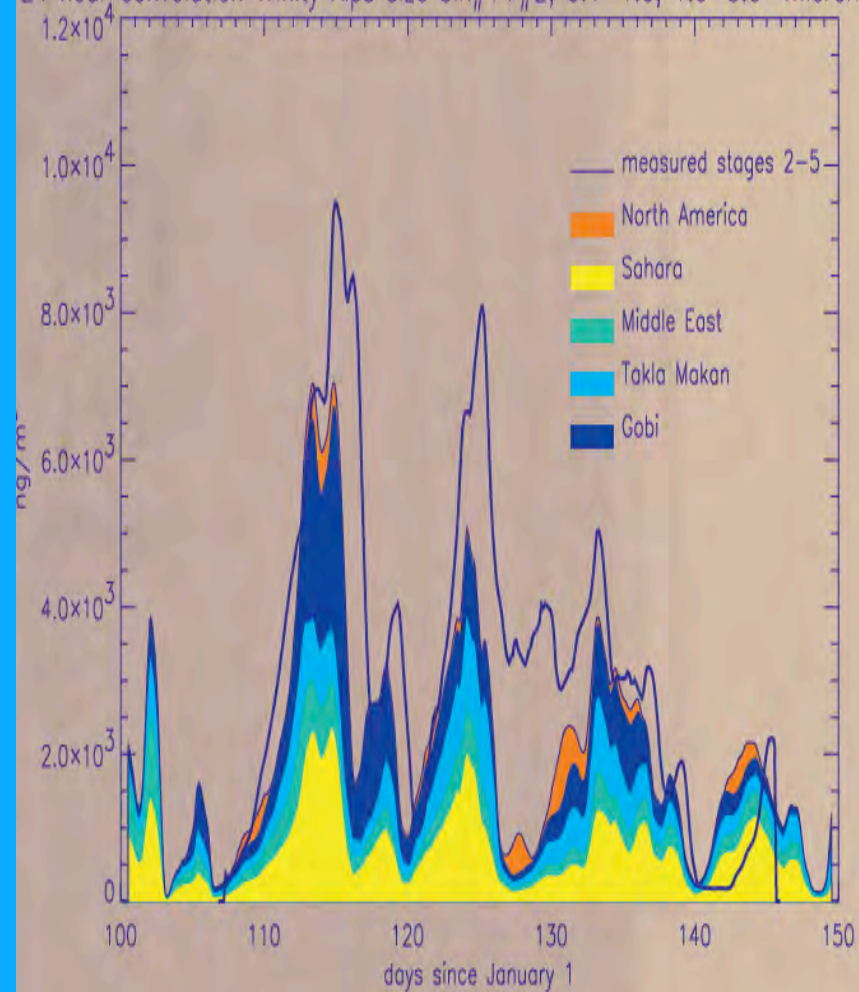
Figure 2-14. Seasonal distributions of fine sulfate ( $\mu\text{g}/\text{m}^3$ ).  
(Reference lines at Crater Lake 10th and 90th percentiles.)



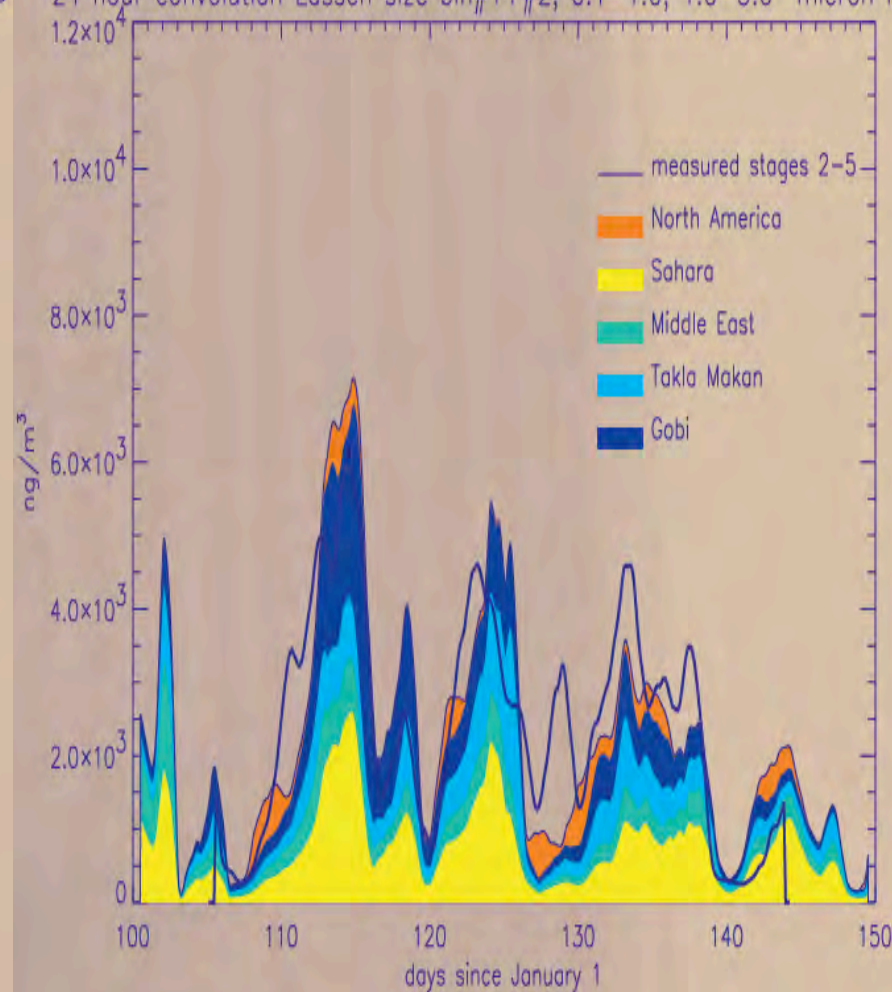


Cameron-Smith, P. *et al.*, (2005), Impact of Long-Range Dust Transport on Northern California in Spring 2002, Internal Report Lawrence Livermore Lab

24 hour convolution Trinity Alps size bin#1+#2, 0.1–1.0, 1.0–3.0 micron radius



24 hour convolution Lassen size bin#1+#2, 0.1–1.0, 1.0–3.0 micron radius



# Preliminary Conclusions...

- We are confirming results from our past work (especially that from 2002).
- Mt. Tamalpais is an appropriate upwind location for particle observations relevant to climate.
- The Snow Laboratory is influenced by numerous sources as well as representing long-range transported air. More work to understand the dynamics at this site is needed.
- Lassen continues to observe long-range transported air with little local influence during the Spring. Long-term observations will reveal seasonal influences.
- Blodgett Forest (the the HQ) is not an appropriate observatory (at least in Spring) likely due to significant tree canopy.